What is claimed is:

1. An arrayed waveguide grating having a slab-waveguide, the slab-waveguide comprising:

a plurality of input ports for inputting signals of different wavelengths in correspondence to these wavelengths;

an output port disposed on the focus position of the 0-th order diffraction beams inputted from the input ports for outputting a signal obtained as a result of multiplexing of the individual wavelengths; and

a monitor signal port disposed on the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input ports for monitoring the multiplexed signal.

2. An arrayed waveguide grating having a slab-waveguide, the slab-waveguide comprising:

a plurality of input ports for inputting signals of different wavelengths in correspondence to these wavelengths;

an output port disposed on the focus position of the 0-th order diffraction beams inputted from the input ports for outputting a signal obtained as a result of multiplexing of the individual wavelengths; and

a higher order diffraction beam reflecting means disposed on the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input ports for reflecting the higher

order diffraction beams to the side of the plurality of input ports.

3. An arrayed waveguide grating having a slab-waveguide, the slab-waveguide comprising:

a plurality of input ports for inputting signals of different wavelengths in correspondence to these wavelengths;

an output port disposed on the focus position of the 0-th order diffraction beams inputted from the input ports for outputting a signal obtained as a result of multiplexing of the individual wavelengths;

a higher order diffraction beam reflecting means disposed on the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input ports for reflecting the higher order diffraction beams to the side of the plurality of input ports; and

one or more monitor signal ports disposed at a position or positions other than the plurality of input ports for taking out a signal or signals reflected from the higher order diffraction beam reflecting means.

4. An optical transmission system comprising:

a plurality of signal sources each provided for each peculiar wavelength, an input waveguide for inputting signals of different wavelengths from these signal sources in correspondence to these wavelengths, a channel

waveguide array having waveguides with lengths progressively increasing by a predetermined waveguide length difference, an input side slab-waveguide inter-connecting the input side of the channel waveguide array and the input waveguide, and an output side slab-waveguide which has output ports inter-connecting to the output side of the channel waveguide array and disposed at the focus position of the 0-th order diffraction beams inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array for outputting a wavelength multiplexed signal;

an output waveguide connected to the output port for outputting the multiplexed signal to be transmitted;

a monitor signal separating means for demultiplexing, by using the channel waveguide array, the multiplexed signal obtained in the output side slab-waveguide at the focus position of higher order diffraction beams other than the 0-the order obtained from the signals from the input waveguide, thereby separating the monitor signals of wavelengths corresponding to those of the signals inputted from the input waveguides;

an output level detecting means for detecting, from the signals of different wavelengths obtained from the monitor signal separating means, the output levels of the individual wavelength signals from the plurality of signal sources; and

a signal source power control means for controlling the power levels of the plurality of signal sources

according to the output levels of the individual wavelength signals from the plurality of signal sources as detected by the output level detecting means.

5. An optical transmission system comprising:

a plurality of signal sources each provided for each peculiar wavelength;

an input waveguide for inputting signals of different wavelengths from these signal sources in correspondence to these wavelengths;

a channel waveguide array having waveguides with lengths progressively increasing by a predetermined waveguide length difference;

an input side slab-waveguide inter-connecting the input side of the channel waveguide array and the input waveguide;

an output side slab-waveguide including an output port connected to the output side of the channel waveguide array and disposed at the focus position of the 0-th order diffraction beams inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array for outputting a wavelength multiplexed signal and a monitor signal port disposed at the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input waveguide;

an output waveguide connected to the output port for outputting the multiplexed signal to be transmitted;

a monitor signal separating means for demultiplexing or separating, by using the channel waveguide array, the individual wavelength monitor signals from the wavelength multiplexed signal obtained from the monitor port;

an output level detecting means for detecting, from the signals of individual wavelengths obtained from the monitor signal separating means, the output levels of the individual wavelength signals from the plurality of signal sources; and

a signal source power control means for controlling the power levels of the plurality of signal sources according to the output levels of the individual wavelength signals from the plurality of signal sources as detected by the output level detecting means.

6. An optical transmission system comprising:

an input waveguide for inputting signals of different wavelengths in correspondence to these wavelengths;

a channel waveguide array having waveguides with lengths progressively increasing by a predetermined waveguide length difference;

an input side slab-waveguide inter-connecting the input side of the channel waveguide array and the input waveguide;

an output side slab-waveguide including an output port connected to the output side of the channel waveguide

array and disposed at the focus position of the 0-th order diffraction beams inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array for outputting a wavelength multiplexed signal;

an output waveguide connected to the output port for outputting the multiplexed signal to be transmitted;

a monitor signal separating means for demultiplexing or separating, by using the channel waveguide array, the multiplexed signal obtained at the focus position of higher order diffraction beam other than 0-th order of the multiplexed signals inputted from the input waveguide in the output slab-waveguide to obtain the individual wavelength monitor signal signals;

an output level detecting means for detecting, from the signals of individual wavelengths obtained from the monitor signal separating means, the output levels of the individual wavelength; and

a signal incidence level control means for controlling the incidence levels of the individual wavelength signal signals incident on the plurality of input waveguides according to the output levels of the individual wavelength signals as detected by the output level detecting means.

7. An optical transmission system comprising:

a plurality of input waveguides for inputting signals of different wavelengths in correspondence to

these wavelengths;

a channel waveguide array having waveguides with lengths progressively increasing by a predetermined waveguide length difference;

an input side slab-waveguide inter-connecting the input side of the channel waveguide array and the input waveguide;

an output side slab-waveguide including an output port connected to the output side of the channel waveguide array and disposed at the focus position of the 0-th order diffraction beams inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array for outputting a wavelength multiplexed signal and a monitor signal port disposed at the focus position of higher order diffraction beams other than the 0-th order obtained from the signal inputted from the input waveguide;

an output waveguide connected to the output port for outputting the multiplexed signal to be transmitted;

a monitor signal separating means for demultiplexing or separating, by using the channel waveguide array, the wavelength multiplexed signal obtained from the monitor port to obtain the individual wavelength monitor outputs;

an output level detecting means for detecting, from the signals of individual wavelengths obtained from the monitor signal separating means, the output levels of the individual wavelength; and

a signal incidence control means for controlling the

incidence levels of the individual wavelength signals incident on the plurality of input waveguides according to the output levels of the individual wavelength signals as detected by the output level detecting means.

8. An optical transmission system comprising:

an input waveguides for inputting signals of different wavelengths in correspondence to these wavelengths;

a channel waveguide array having waveguides with lengths progressively increasing by a predetermined waveguide length difference;

an input side slab-waveguide inter-connecting the input side of the channel waveguide array and the input waveguide;

an output side slab-waveguide, including an output port connected to the output side of the channel waveguide array and disposed at the focus position of the 0-th order diffraction beams inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array for outputting a wavelength multiplexed signal;

an output waveguide connected to the output port for outputting the multiplexed signal to be transmitted; and

a monitor signal separating means for demultiplexing or separating, by using the channel waveguide array, the multiplexed signal obtained at the focus position of higher order diffraction beam other than

0-th order of the multiplexed signals inputted from the input waveguide in the output slab-waveguide to obtain the individual wavelength monitor signal outputs.

9. An arrayed waveguide grating comprising:

an input waveguides for inputting signals of different wavelengths in correspondence to these wavelengths;

a channel waveguide array having waveguides with lengths progressively increasing by a predetermined waveguide length difference;

an input side slab-waveguide inter-connecting the input side of the channel waveguide array and the input waveguides and having monitor signal ports for monitoring signals returning from the channel waveguide array;

an output side slab-waveguide including an output side slab-waveguide including an output port connected to the output side of the channel waveguide array and disposed at the focus position of the 0-th order diffraction beams inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array for outputting a wavelength multiplexed signal and a signal returning means for causing a signal converged on the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input waveguides to return from the focus position to the input side; and

an output waveguide connected to the output port for

obtaining the multiplexed signal.

10. The arrayed waveguide grating according to claim 9, wherein the signal returning means is a reflecting means disposed at the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input waveguides for reflecting the higher order diffraction beams to the side of the plurality of input waveguides.

11. An arrayed waveguide grating comprising:

a substrate;

input waveguides disposed on the substrate for inputting signals of individual wavelengths in correspondence thereto;

a channel waveguide grating disposed on the substrate and having waveguides with lengths progressively increasing by a predetermined waveguide length difference;

an input side slab-waveguide disposed on the substrate and inter-connecting the input side of the channel waveguide array and the input waveguides;

an output side slab-waveguide connected to the output side of the channel waveguide array and disposed at the focus position of the 0-th diffraction beams obtained from the signals inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array for outputting a wavelength

multiplexed signal and a monitor signal port disposed at the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input waveguides;

an output waveguide connected to the output port;

a waveguide disposed on the substrate and having one terminal connected to the monitor signal port of the output side slab-waveguide and the other terminal disposed on the inner side of one end face of the substrate; and

a reflecting means disposed at the other terminal of the waveguide for reflecting the signal led out from the monitor signal port.

12. An arrayed waveguide grating comprising:

a substrate;

input waveguides disposed on the substrate for inputting signals of individual wavelengths in correspondence thereto;

a channel waveguide grating disposed on the substrate and having waveguides with lengths progressively increasing by a predetermined waveguide length difference;

an input side slab-waveguide disposed on the substrate and inter-connecting the input side of the channel waveguide array and the input waveguides;

an output side slab-waveguide connected to the output side of the channel waveguide array and having a wavelength multiplexed signal output port disposed at the

focus position of the 0-th diffracted signals obtained from the signals inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array, a monitor signal output port disposed at the focus position of the higher order diffraction beams other than the 0-th order diffraction beams obtained from the signals inputted from the input waveguides and a monitor signal input port for outputting an output from a predetermined path, through which the signal outputted from the monitor signal output port returns, toward the side of the plurality of input waveguides;

an output waveguide connected to the output port; and

a waveguide disposed on the substrate and optically connecting the monitor signal output port and monitor signal input port.

13. An arrayed waveguide grating comprising:

a substrate;

input waveguides disposed on the substrate for inputting signals of individual wavelengths in correspondence thereto;

a channel waveguide grating disposed on the substrate and having waveguides with lengths progressively increasing by a predetermined waveguide length difference;

an input side slab-waveguide disposed on the substrate and inter-connecting the input side of the

channel waveguide array and the input waveguides;

an output side slab-waveguide connected to the output side of the channel waveguide array and having a wavelength multiplexed signal output port disposed at the focus position of the 0-th diffracted signals obtained from the signals inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array, and a monitor signal port disposed at the focus position of the higher order diffraction beams other than the 0-th order diffraction beams obtained from the signals inputted from the input waveguides;

an output waveguide connected to the output port;

a waveguide disposed on the substrate and having one terminal connected to the monitor signal port of the output side slab-waveguide and the other terminal disposed on one end face of the substrate; and

a reflecting means disposed on the other terminal of the waveguide for reflecting the signal led out from the monitor signal port.

14. An arrayed waveguide grating comprising:

a substrate;

input waveguides disposed on the substrate for inputting signals of individual wavelengths in correspondence thereto;

a channel waveguide grating disposed on the substrate and having waveguides with lengths progressively increasing by a predetermined waveguide

length difference;

an input side slab-waveguide disposed on the substrate and inter-connecting the input side of the channel waveguide array and the input waveguides;

an output side slab-waveguide connected to the output side of the channel waveguide array and having a wavelength multiplexed signal output port disposed at the focus position of the 0-th diffracted signals obtained from the signals inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array, a monitor signal output port disposed at the focus position of the higher order diffraction beams other than the 0-th order diffraction beams obtained from the signals inputted from the input waveguides and a monitor signal input port for outputting an output from a predetermined path, through which the signal outputted from the monitor signal output port returns, toward the side of the plurality of input waveguides;

a monitor signal output waveguide disposed on the substrate and having one terminal connected to the monitor signal port of the output side slab-waveguide and the other terminal disposed on one end face of the substrate;

a monitor signal input waveguide disposed on the substrate and having one terminal connected to the monitor signal input port in the output side slab-waveguide and the other terminal disposed at a position other than the afore-mentioned predetermined position on the end face of the substrate; and

an optical fiber for optically inter-connecting the monitor signal output waveguide at one end of the substrate and the corresponding terminal of the monitor signal input waveguide.

15. An arrayed waveguide grating comprising:

a substrate;

input waveguides disposed on the substrate for inputting signals of individual wavelengths in correspondence thereto;

a channel waveguide grating disposed on the substrate and having waveguides with lengths progressively increasing by a predetermined waveguide length difference;

an input side slab-waveguide disposed on the substrate and inter-connecting the input side of the channel waveguide array and the input waveguides;

an output side slab-waveguide connected to the output side of the channel waveguide array and having a wavelength multiplexed signal output port disposed at the focus position of the 0-th diffracted signals obtained from the signals inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array, and a monitor signal port disposed at the focus position of the higher order diffraction beams other than the 0-th order diffraction beams obtained from the signals inputted from the input waveguides;

an output waveguide disposed on the substrate and

having one terminal connected to the monitor signal port of the output side slab-waveguide and the other terminal disposed on a predetermined position of the substrate;

an optical fiber having one terminal connected to the afore-mentioned other terminal of the output waveguide located on the end face of the substrate; and

a reflecting means connected to the other terminal of the optical fiber for reflecting the signal led out from that other terminal.

16. An arrayed waveguide grating comprising:

input waveguides for inputting signals of individual wavelengths in correspondence to these wavelengths;

a channel waveguide array having waveguides with lengths progressively increasing by a predetermined waveguide length difference;

a feedback waveguide for feeding back a multiplexed monitor signal;

an input side slab-waveguide, in which the input waveguides and the feedback waveguide are disposed and the input side of the channel waveguide array is disposed on the output side;

an output side slab-waveguide connected to the output side of the channel waveguide array and having an output port disposed on the focus position of the 0-th diffraction beams obtained from the signal inputted from the input waveguides through the input side slab-waveguide

and the channel waveguide array for outputting the wavelength multiplexed signal, a feedback port disposed at the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input waveguides and one or plurality monitor signal ports for outputting monitor signals separated from the multiplexed signal signal inputted from the feedback waveguide through the channel waveguide array;

an output waveguide connected to the output port of the output side slab-waveguide; and

monitor signal output waveguide connected to the monitor signal port.

17. An arrayed waveguide grating comprising:

input waveguides for inputting signals of individual wavelengths in correspondence to these wavelengths;

a channel waveguide array having waveguides with lengths progressively increasing by a predetermined waveguide length difference;

a feedback fiber for feeding back a multiplexed signal monitor signal;

an input side slab-waveguide, in which the input waveguides and the feedback fiber are disposed on one side and the input side of the channel waveguide array is disposed on the output side;

an output side slab-waveguide connected to the

output side of the channel waveguide array and having an output port disposed on the focus position of the 0-th diffraction beams obtained from the signal is inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array for outputting the wavelength multiplexed signal, a feedback port disposed at the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input waveguides and one or plurality monitor signal ports for outputting monitor signals separated from the multiplexed signal inputted from the feedback fiber through the channel waveguide array;

an output waveguide connected to the output port of the output side slab-waveguide; and

monitor signal output waveguide connected to the monitor signal port.

18. An arrayed waveguide grating comprising:

input waveguides for inputting signals of individual wavelengths in correspondence to these wavelengths;

monitor waveguides disposed at positions individual from the input waveguides for outputting monitor signals;

a channel waveguide array having waveguides with lengths progressively increasing by a predetermined waveguide length difference;

an output side slab-waveguide connected to the output side of the channel waveguide array and including

a signal returning means for causing a signal converged on the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input waveguides through the input side slab-waveguide and the channel waveguide array;

an input side slab-waveguide inter-connecting the input waveguides, the input side of the channel waveguide array and the monitor waveguides for outputting the signal inputted from the output side slab-waveguide through the channel waveguide array to the monitor signal waveguide;

an output port disposed on the output side slab-waveguide at the focus position of the 0-th diffraction beams obtained from the signal inputted from the input waveguides for outputting the wavelength multiplexed signal; and

an output waveguide connected to the output port.

19. The arrayed waveguide grating according to claim 18, wherein the monitor waveguide is disposed at the focus position of the 0-th order diffraction beams obtained from the signals returning from the output side slab-waveguide to the input side slab-waveguide, and the focus positions of the 1-st order diffraction beams are disposed at positions mid way between adjacent ones of the input waveguides.

20. The arrayed waveguide grating according to claim 18, wherein the monitor waveguides are disposed

alternately with the input waveguides at the input side slab-waveguide.

21. The arrayed waveguide grating according to claim 18, wherein the input positions of the input side slab-waveguide corresponding to the individual wavelengths of the inputs inputted to the input waveguides are disposed mid way between the 0-th and 1-st diffraction beams returning from the channel waveguide array.

22. The arrayed waveguide grating according to claim 18, wherein a region covering the positions of the monitor signal ports in the input side slab-waveguide is set such that it does not overlap but separate from a region covering the positions of the input ports.

23. The arrayed waveguide grating according to claim 18, wherein the signal returning means includes a higher order diffraction beam reflecting mirror disposed in the output side slab-waveguide at the focus position of the higher order diffraction beams, and a signal returning mirror disposed at a position other than the position of the higher order diffraction beam reflecting mirror and the focus position of the 0-th order diffraction beams for returning the signals reflected by the higher order diffraction beam mirror to the input slab-waveguide side.

24. The arrayed waveguide grating according to claim

18, wherein the signal returning means includes a signal returning mirror disposed in the output side slab-waveguide at the focus position of the higher order diffraction beams for returning the higher order diffraction beams incident on that position along a path at a signal angle from the optical axis to the input slab-waveguide side.

25. The arrayed waveguide grating according to claim 18, wherein the signal returning means includes a mirror disposed on one end face of a substrate with the output side slab-waveguide, a first monitor signal waveguide for leading the signal converged on the focus position of the higher order diffraction beams to the afore-mentioned mirror, and a second monitor signal waveguide, which causes the signal reflected by the afore-mentioned mirror to be inputted to the output side slab-waveguide from a position thereof other than the output port and thereof the focus position of the higher order diffraction beams other than the 0-th order for being outputted to the input slab-waveguide side.

26. The arrayed waveguide grating according to claim 18, wherein the signal returning means a monitor signal waveguide, which the signal converged on the focus position of the higher order diffraction beams is inputted to and causes the inputted to be inputted to the output side slab-waveguide from a position thereof other than the

output port and thereof the focus position of the higher order diffraction beams for being outputted to the input slab-waveguide side.

27. The arrayed waveguide grating according to claim 18, wherein the signal returning means includes an optical fiber, which the signal converged on the focus position of the higher order diffraction beams is inputted to and causes the input to be inputted to the output side slab-waveguide from a position thereof other than the output port and thereof the focus position of the higher order diffractions beams for being outputted to the input slab-waveguide side.

28. An optical communication system comprising:

an optical communication means for outputting signal signals of individual wavelengths as parallel signals;

a multiplexer constituted by an arrayed waveguide grating for wavelength multiplexing the signals of the individual wavelengths outputted from the optical communication means;

an optical transmission path for transmitting the wavelength multiplexed signal outputted from the multiplexer;

a node provided on the optical transmission path and including an arrayed waveguide grating;

a demultiplexer constituted by an arrayed waveguide

grating for separating the individual wavelength signals from the signal inputted through the optical transmission path and the node thereon;

an optical reception means for receiving the individual wave signals separated by the multiplexer; and

the multiplexer including a plurality of input waveguides for inputting signals of individual wavelengths in correspondence to these wavelengths, and a slab-waveguide having a wavelength multiplexed signal output port disposed at the focus position of the 0-th order diffraction beams of the signals inputted from the input waveguides through an input side slab-waveguide and a channel waveguide array and monitor signal port disposed at the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input waveguides or monitoring the wavelength multiplexed signal.

29. An optical transmission system comprising a transmission path loop having a plurality of nodes connected to one another by transmission paths such that a wavelength multiplexed signal is sent out to these transmission paths;

the nodes each including a first arrayed waveguide grating for separating signals of individual wavelengths from the inputted wavelength multiplexed signal and a second arrayed wavelength waveguide grating for waveguide wavelength multiplexing the separated signal signals of

the individual wavelengths;

the second arrayed waveguide grating having a plurality of input waveguides for inputting signals of individual wavelengths in correspondence to these signals, and a slab-waveguide having a wavelength multiplexed signal output port disposed at the focus position of the 0-th diffraction beams obtained from the signals inputted from the input waveguides through an input side slab-waveguide and a channel waveguide array and a monitor signal port disposed at the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input waveguides for monitoring the wavelength multiplexed signal.

30. An optical communication system comprising:

an optical communication means for outputting signal signals of individual wavelengths as parallel signals;

a multiplexer constituted by an arrayed waveguide grating for wavelength multiplexing the individual wavelength signals outputted from the optical communication means;

an optical transmission path for transmitting the wavelength multiplexed signal outputted from the multiplexer;

a node disposed on the optical transmission path and including an arrayed waveguide grating;

a demultiplexer for demultiplexing the signal

inputted thereto along the optical transmission path and on the node thereon to separate the individual wavelength signals;

an optical reception means for receiving the separated individual wavelength signals from the demultiplexer; and

the demultiplexer including a plurality of input waveguides and a slab waveguide having a wavelength multiplexed signal output port disposed at the focus position of the 0-th order diffraction signals inputted from the input waveguides through an input side slab-waveguide and a channel waveguide array, a higher order diffraction beam reflecting means disposed at the focus position of higher order diffraction beam positions other than the 0-th order obtained from the signals inputted from the input waveguides for reflecting the higher order diffraction beams to the side of the plurality of input waveguides and one or more monitor signal ports disposed at a position or positions other than the ports of the plurality of input waveguides for inputting a signal or signals reflected by the higher order signal reflecting means.

31. An optical communication system comprising a transmission path loop having a plurality of nodes connected to one another by transmission paths such that a wavelength multiplexed signal is sent out to these transmission paths;

the nodes each including a first arrayed waveguide grating for separating signals of individual wavelengths from the inputted wavelength multiplexed signal and a second arrayed wavelength waveguide grating for waveguide wavelength multiplexing the separated signal signals of the individual wavelengths;

the second arrayed waveguide grating having a slab-waveguide which includes a plurality of input waveguides for inputting signals of individual wavelengths in correspondence to these signals, a multiplexed signal output port disposed at the focus position of the 0-th diffraction beams obtained from the signals inputted from the input waveguides through an input side slab-waveguide and a channel waveguide array, a higher order diffraction beam reflecting means for reflecting the higher order diffraction beams to the side of the plurality of input waveguides and a plurality of monitor signal ports disposed at positions other than the port positions of the plurality of input waveguides for inputting the signals reflected by the higher order diffraction beams, and a monitor signal port disposed at the focus position of higher order diffraction beams other than the 0-th order obtained from the signals inputted from the input waveguides for monitoring the wavelength multiplexed signal.